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EXAMINER	
MARKHAM, WESLEY D	
ART UNIT	PAPER NUMBER
1762	9

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/801,542	Applicant(s) BONDESTAM ET AL.	
	Examiner Wesley D Markham	Art Unit 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 September 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-56* is/are pending in the application.

4a) Of the above claim(s) *1-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31-56* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2,3,4,6* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group II, Claims 31 – 56, drawn to a method for growing a thin film on a substrate, in Paper No. 8 is acknowledged. As such, Claims 1 – 30 are withdrawn from further consideration by the examiner as being drawn to a non-elected invention. Claims 1 – 56 are currently pending in U.S. Application Serial No. 09/801,542, and an Office Action on the merits follows.

Information Disclosure Statement

2. The information disclosure statements filed by the applicant (i.e., as paper #2 on 4/17/01; as paper #3 on 5/30/01; as paper #4 on 4/24/02; and as paper #6 on 9/4/02) are acknowledged, and the references listed thereon have been considered as indicated on the attached copies of the PTO-1449 forms. However, regarding reference number "46" of the IDS filed as paper #2 on 4/17/01, the IDS fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of the publication, which is not in the English language. The reference has been placed in the application file, but the information referred to therein has not been considered.

Drawings

3. The formal drawings (8 sheets, 8 figures) filed on 3/7/2001 are acknowledged and approved by the examiner.

Specification

4. The disclosure is objected to because of the following informalities: The use of the trademarks DOWTHERM A and SYLTHERM 800 has been noted in this application (see page 18, paragraph 1 of the applicant's specification). They should be capitalized wherever they appear and be accompanied by the generic terminology. Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks. Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 50 – 56 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Specifically, Claim 50 (from which Claims 51 – 56 depend) recites the limitation "the substrate" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

9. Claims 31 and 43 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim et al. (USPN 6,306,216 B1).

10. Regarding independent Claim 31, Kim et al. teach a method for growing a thin film on a substrate by exposing the substrate in a reaction chamber defined by a plurality of walls to alternate surface reactions of vapor phase reactants (Abstract, Figures 2 and 4a, Col.1, lines 8 – 15, Col.2, lines 8 – 28, Col.4, lines 2 – 7 and 35 – 65, Col.5, lines 1 – 10, and Col.11, lines 13 – 25 and 41 – 45), the method comprising controlling a chamber wall temperature of at least those portions of the chamber walls that are exposed to vapor-phase reactants (Figure 2, reference

number "400", Figure 4a, reference numbers "705", "705a", and "705b", Col.3, lines 49 – 52, Col.4, lines 18 – 21, and Col.8, lines 17 – 59), loading the substrate onto a support structure inside the reaction chamber (Figures 2 and 4a, Col.6, lines 43 – 67, Col.7, lines 1 – 16 and 60 – 67, and Col.8, lines 1 – 10), controlling a substrate support temperature independently of the chamber wall temperature (Figure 4a, reference number "702", Col.8, lines 16 – 64, Col.9, lines 66 – 67, and Col.10, lines 1 – 14), and alternately and sequentially feeding at least two vapor phase reactants into the reaction chamber (Abstract, Col.4, lines 2 – 7 and 35 – 65, Col.5, lines 1 – 10, and Col.11, lines 13 – 25 and 41 – 45). Regarding Claim 43, Kim et al. also teach that the chamber wall temperature is maintained higher than a temperature of the reactants as they enter the reaction chamber (Col.8, lines 51 – 52, and Col.12, lines 8 – 11).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the

obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claims 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (USPN 6,306,216 B1).

14. Kim et al. explicitly teach all the limitations of Claims 32 and 33 as set forth above in paragraph 10, except for a method wherein the chamber wall temperature is controlled to be within approximately 10° C of the substrate support temperature (Claim 32), preferably to be approximately equal to the substrate support temperature (Claim 33). However, Kim et al. do teach that the wafer heating unit (i.e., the support heating unit) is used for heating the wafers to a "predetermined constant temperature", and the reaction chamber heating unit (i.e., the wall heating unit) is used for heating the reaction chamber to a "predetermined constant temperature" (Col.4, lines 14 – 21). In addition, Kim et al. teach that the heating unit "400" (i.e., the entire heating system that is made up of the wafer heating unit and the reaction chamber heating unit – see Figure 2) is used to heat the reaction surfaces of the wafer and the reaction chamber to a constant temperature (Col.6, lines 14 – 19). Therefore, it would have been obvious to one of ordinary skill in the art to control the chamber wall temperature and the substrate support temperature of Kim et al. to be approximately equal with the reasonable expectation of

successfully accomplishing a goal of Kim et al. (i.e., to heat the reaction surfaces of the wafer and the reaction chamber to a constant temperature).

15. Claims 34 – 38, 44, 45, and 49 – 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (USPN 6,306,216 B1) in view of Suntola et al. (USPN 6,015,590) and Yokoyama et al. (USPN 4,897,709).

16. Kim et al. teach all the limitations of Claim 34 as set forth above in paragraph 10, except for a method wherein the substrate support temperature is maintained at a first temperature and the chamber wall temperature is maintained at a second temperature different from the substrate support temperature. However, Kim et al. are concerned with depositing a thin film on a substrate using an atomic layer deposition (ALD) process (Abstract). Suntola et al. teach that, in an ALD process, it is desirable to use a "hot-wall" reactor system so that an atom or molecule species impinging on the reactor wall will not condense thereon and may become re-vaporized, whereby advantageous conditions are created for repeated impingement of the species on the substrate. This "multi-shot" principle can provide improved material utilization efficiency (Col.2, lines 42 – 54). Yokoyama et al. teach that, in the art of vapor deposition, a "hot-wall" reactor system / method is one in which the temperature of the reaction chamber walls is higher than that of the substrate (Col.2, lines 63 – 66). Therefore, it would have been obvious to one of ordinary skill in the art to utilize the "hot-wall" reactor principle (i.e., to heat the chamber walls of Kim et al. to a temperature higher than the substrate support temperature) in the

process of Kim et al. with the reasonable expectation of successfully and advantageously preventing atomic or molecular species from condensing on the reactor walls (i.e., preventing contamination of the reactor walls) and allowing the reactive species to become "re-vaporized", thereby creating a "multi-shot" effect that provides improved material utilization efficiency.

17. The combination of Kim et al., Suntola et al., and Yokoyama et al. also teaches / suggests all the limitations of Claims 35 – 38 as set forth above in paragraphs 10 and 16, including a method wherein / further comprising:

- Claim 35 – A difference between the first temperature and the second temperature is selected to maintain a lower rate of film growth upon the chamber walls as compared to the substrate. Specifically, Suntola et al. teach that the "hot-wall" principle prevents the reactive species from condensing on the reactor walls (i.e., prevents contamination of the reactor walls) while allowing the species to repeatedly impinge / deposit on the substrate.
- Claim 36 – The difference between the first temperature and the second temperature is greater than about 20° C. While this limitation is not explicitly taught by the aforementioned combination of references, the combination is clearly drawn to successfully depositing a film by ALD on a substrate while preventing undesired condensation / contamination of the reactor walls. Therefore, absent any showing of criticality or unexpected results, it would have been obvious to one of ordinary skill in the art to choose any

appropriate combination of substrate support temperatures / chamber wall temperatures (i.e., including a temperature difference of greater than about 20° C) so that deposition would occur on the surface of the substrate and would not occur on the reaction chamber walls. The specific combination of temperatures / temperature difference would be chosen by the purveyor in the art depending on the reactants used and the film to be deposited.

- Claim 37 – The chamber wall temperature is maintained higher than the substrate support temperature (see paragraph 16 above).
- Claim 38 – The chamber wall temperature is controlled at a level low enough to prevent thermal decomposition of the reactants. While this limitation is not explicitly taught by the aforementioned combination of references, the combination is clearly drawn to successfully depositing a film by ALD on a substrate while preventing undesired contamination of the reactor walls. Therefore, it would have been obvious to one of ordinary skill in the art to choose a reactor wall temperature that is below the thermal decomposition temperature of the reactants in order to prevent contamination of the reactor walls as desired by Kim et al. and Suntola et al.

18. The combination of Kim et al., Suntola et al., and Yokoyama et al. teaches all the limitations of independent Claim 44 as set forth above in paragraphs 10 and 16. Please note that the "first temperature controller" and the "second temperature controller" required by independent Claim 44 correspond to the wafer heating unit and the reaction chamber heating unit, respectively, of Kim et al.

19. The combination of Kim et al., Suntola et al., and Yokoyama et al. also teaches all the limitations of Claims 45 and 49 as set forth above in paragraph 18 and below, including a method wherein / further comprising:

    - Claim 45 – The second temperature is maintained higher than the first temperature (see paragraph 16 above).
    - Claim 49 – The second temperature (i.e., the wall temperature) is selected to lower a rate of film growth upon the walls relative to the substrate (see explanation regarding Claim 35 above).

20. Regarding independent Claim 50 (from which Claims 51 – 56 depend), the combination of Kim et al., Suntola et al., and Yokoyama et al. teaches a method for preventing unwanted deposition on walls of an ALD reaction chamber (see Figures 2 and 4a of Kim et al.), the method comprising controlling a temperature of the substrate and independently controlling a temperature of at least those portions of the chamber walls exposed to reactants (see paragraphs 10 and 16 above), such that a rate of deposition by self-limited ALD on the substrate is maximized while film growth on the walls is reduced relative to controlling a temperature of the substrate alone (see paragraphs 16 and 17 above). Regarding Claims 51 and 52, Kim et al. also teach that controlling the chamber wall temperature comprises heating the chamber walls (reference numbers "705", "705a", and "705b", and Col.8, lines 43 – 59), and controlling the substrate temperature comprises heating the substrate (reference number "702" and Col.8, lines 17 – 39). Regarding Claim 53, the combination of Kim et al., Suntola et al., and Yokoyama et al. does not explicitly

teach controlling the wall temperature in a range to accomplish ALD upon the walls. However, as set forth above in paragraph 14, it would have been obvious to one of ordinary skill in the art to control the chamber wall temperature and the substrate support temperature of Kim et al. to be approximately equal. In this case, since (1) the chamber wall temperature and the substrate support temperature are approximately equal, and (2) ALD occurs on the substrate (see Abstract of Kim et al.), the wall temperature is necessarily controlled in a range to accomplish ALD upon the walls (i.e., it is controlled in the same range as the substrate upon which ALD is accomplished). Regarding Claim 54, Suntola et al. teach controlling the wall temperature in a range to avoid condensation and physisorption of reactants upon the walls (Col.2, lines 42 – 54). Regarding Claim 55, the aforementioned combination of references does not explicitly teach controlling the wall temperature in a range to avoid thermal decomposition of reactants upon the walls. However, the combination of references is clearly drawn to successfully depositing a film by ALD on a substrate while preventing undesired contamination of the reactor walls. Therefore, it would have been obvious to one of ordinary skill in the art to choose a reactor wall temperature that is below the thermal decomposition temperature of the reactants in order to prevent contamination of the reactor walls as desired by Kim et al. and Suntola et al. Regarding Claim 56, the combination of Kim et al., Suntola et al., and Yokoyama et al. teaches maintaining the wall temperature in a range to reduce film growth upon the walls relative to deposition rates upon the substrate (see explanation regarding Claim 35 above).

21. Claims 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (USPN 6,306,216 B1) in view of Suntola et al. (USPN 6,015,590) and Yokoyama et al. (USPN 4,897,709), and in further view of Tseng (USPN 5,811,762).

22. The combination of Kim et al., Suntola et al., and Yokoyama et al. teaches all the limitations of Claims 46 and 47 as set forth above in paragraphs 18 and 19, except for a method wherein maintaining the first temperature (i.e., the substrate support temperature) comprises removing heat from the substrate support by circulating a fluid through the substrate support. However, the combination of references does suggest heating the chamber walls of Kim et al. to a temperature higher than the substrate support temperature (see paragraph 16 above). Tseng teaches a substrate support for use in vapor deposition systems in which cooling gas, cooling water, and heated gas are utilized to bring a semiconductor wafer to a desired high or low temperature. The substrate support of Tseng has the benefits of (1) allowing a rapid transition from one temperature to another, and (2) achieving precise temperature control over a wide range, thereby yielding increased flexibility of process control (Abstract). Therefore, it would have been obvious to one of ordinary skill in the art to utilize a substrate support as taught by Tseng (i.e., with cooling water / cooling gas circulating through the substrate support) in the process of Kim et al. in order to achieve a situation in which the chamber walls of Kim et al. are heated to a temperature higher than the substrate support temperature, as

suggested by the aforementioned combination of references. By utilizing such a substrate support, one of ordinary skill in the art would have realized the benefits of allowing a rapid transition from one temperature to another and achieving precise temperature control over a wide range, thereby yielding increased flexibility of process control.

23. Claims 34 – 36, 39 – 41, 44, and 48 – 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (USPN 6,306,216 B1) in view of Eichman et al. (USPN 5,348,587).

24. Kim et al. teach all the limitations of Claim 34 as set forth above in paragraph 10, except for a method wherein the substrate support temperature is maintained at a first temperature and the chamber wall temperature is maintained at a second temperature different from the substrate support temperature. However, Kim et al. are concerned with depositing a thin film on a substrate using an atomic layer deposition (ALD) process (Abstract). Eichman et al. teach that, in the art of manufacturing semiconductor devices by using a vapor deposition process, it is desirable to elevate (i.e., heat) the surface of the wafer to a reaction temperature while maintaining other parts of the reactor at a lower temperature, which prevents the deposition of coating material on surfaces other than on the surface of the substrate to be coated (Col.1, lines 18 – 34). Therefore, it would have been obvious to one of ordinary skill in the art to heat the surface of the wafer of Kim et al. to a desired reaction temperature while maintaining other parts of the reactor (e.g., the

chamber walls) at a lower temperature with the reasonable expectation of successfully preventing deposition of reaction materials on surfaces other than the substrate surface (i.e., the chamber walls). By maintaining the reactor walls at a temperature lower than the substrate temperature and minimizing deposition on the reactor walls, one achieves the benefits of (1) preventing interference with reactor operation and (2) preventing substrate contamination (Col.1, lines 40 – 42).

25. The combination of Kim et al. and Eichman et al. also teaches / suggests all the limitations of Claims 35, 36, and 39 – 41 as set forth above in paragraphs 10 and 24, including a method wherein / further comprising:

- Claim 35 – A difference between the first temperature and the second temperature is selected to maintain a lower rate of film growth upon the chamber walls as compared to the substrate. Specifically, Eichman et al. teaches elevating (i.e., heating) the surface of the wafer to a reaction temperature while maintaining other parts of the reactor (e.g., chamber walls) at a lower temperature, which prevents the deposition of coating material on surfaces other than on the surface of the substrate to be coated (Col.1, lines 18 – 34).
- Claim 36 – The difference between the first temperature and the second temperature is greater than about 20° C. While this limitation is not explicitly taught by the aforementioned combination of references, the combination is clearly drawn to successfully depositing a film on a substrate while preventing undesired deposition on / contamination of the reactor walls.

Therefore, absent any showing of criticality or unexpected results, it would have been obvious to one of ordinary skill in the art to choose any appropriate combination of substrate support temperatures / chamber wall temperatures (i.e., including a temperature difference of greater than about 20° C) so that deposition would occur on the surface of the substrate and would not occur on the reaction chamber walls. The specific combination of temperatures / temperature difference would be chosen by the purveyor in the art depending on the reactants used and the film to be deposited.

- Claim 39 – The chamber wall temperature is maintained lower than the substrate support temperature (see paragraph 24 above).
- Claims 40 and 41 – The chamber wall temperature is controlled at a level high enough to prevent condensation and physisorption of one of the reactants on the wall. While this limitation is not explicitly taught by the aforementioned combination of references, the combination is clearly drawn to successfully depositing a film on a substrate while preventing undesired deposition on / contamination of the reactor walls. Therefore, it would have been obvious to one of ordinary skill in the art to utilize a chamber wall temperature that is high enough to prevent condensation and physisorption of one of the reactants on the wall in order to prevent contamination of the reactor walls as desired by Kim et al. and Eichman et al.

26. The combination of Kim et al. and Eichman et al. teaches all the limitations of independent Claim 44 as set forth above in paragraphs 10 and 24. Please note that

the "first temperature controller" and the "second temperature controller" required by independent Claim 44 correspond to the wafer heating unit and the reaction chamber heating unit, respectively, of Kim et al.

27. The combination of Kim et al. and Eichman et al. also teaches all the limitations of Claims 48 and 49 as set forth above in paragraph 26 and below, including a method wherein / further comprising:

- Claim 48 – The second temperature is maintained lower than the first temperature (see paragraph 24 above).
- Claim 49 – The second temperature (i.e., the wall temperature) is selected to lower a rate of film growth upon the walls relative to the substrate (see explanation regarding Claim 35 above).

28. Regarding independent Claim 50 (from which Claims 51 – 56 depend), the combination of Kim et al. and Eichman et al. teaches a method for preventing unwanted deposition on walls of an ALD reaction chamber (see Figures 2 and 4a of Kim et al.), the method comprising controlling a temperature of the substrate and independently controlling a temperature of at least those portions of the chamber walls exposed to reactants (see paragraphs 10 and 24 above), such that a rate of deposition by self-limited ALD on the substrate is maximized while film growth on the walls is reduced relative to controlling a temperature of the substrate alone (see paragraphs 24 and 25 above). Regarding Claims 51 and 52, Kim et al. also teach that controlling the chamber wall temperature comprises heating the chamber walls (reference numbers "705", "705a", and "705b", and Col.8, lines 43 – 59), and

controlling the substrate temperature comprises heating the substrate (reference number "702" and Col.8, lines 17 – 39). Regarding Claim 53, the combination of Kim et al. and Eichman et al. does not explicitly teach controlling the wall temperature in a range to accomplish ALD upon the walls. However, as set forth above in paragraph 14, it would have been obvious to one of ordinary skill in the art to control the chamber wall temperature and the substrate support temperature of Kim et al. to be approximately equal. In this case, since (1) the chamber wall temperature and the substrate support temperature are approximately equal, and (2) ALD occurs on the substrate (see Abstract of Kim et al.), the wall temperature is necessarily controlled in a range to accomplish ALD upon the walls (i.e., it is controlled in the same range as the substrate upon which ALD is accomplished). Regarding Claims 54 and 55, the combination of Kim et al. and Eichman et al. does not explicitly teach controlling the wall temperature in a range to avoid condensation, physisorption, and thermal decomposition of reactants upon the walls. However, the combination of references is clearly drawn to successfully depositing a film by ALD on a substrate while preventing undesired deposition on and contamination of the reactor walls. Therefore, it would have been obvious to one of ordinary skill in the art to choose a reactor wall temperature that prevents condensation, physisorption, and thermal decomposition of the reactants on the reactor walls in order to prevent undesired deposition on and contamination of the reactor walls as desired by Kim et al. and Eichman et al. Regarding Claim 56, the combination of Kim et al. and Eichman et al. teaches maintaining the wall

temperature in a range to reduce film growth upon the walls relative to deposition rates upon the substrate (see explanation regarding Claim 35 above).

29. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (USPN 6,306,216 B1) in view of Eichman et al. (USPN 5,348,587), and in further view of Kukli et al. (*J. Electrochem. Soc.*).

30. The combination of Kim et al. and Eichman et al. teaches all the limitations of Claim 42 as set forth above in paragraphs 10, 24, and 25, except for a method wherein one of the reactants is water and the wall is maintained at a temperature of 200° C or higher. Please note that Kim et al. do teach that the reactor walls can have a temperature of, for example, 300° (Col.8, lines 51 – 53). In addition, the process / apparatus of Kim et al. is not drawn or limited to any specific ALE process (i.e., with any specific reactants) but is open to an ALE process in general (Abstract). Further, the process / apparatus of Kim et al. quickly forms uniform thin films on wafer substrates while controlling the thickness of the thin films deposited on the wafers (Col.3, lines 6 – 21). Kukli et al. teach that it was known in the art at the time of the applicant's invention to utilize ALE (i.e., the process taught by Kim et al.) in order to deposit a tantalum oxide thin film from $Ta(OC_2H_5)_5$ and water (Abstract). In this process, the reactor walls are advantageously kept between 225° C and 325° C (i.e., above 200° C) in order to achieve an optimum deposition rate without increasing the temperature to a point at which "CVD-like" growth occurs (page 1671 and Figure 2). It would have been obvious to one of ordinary skill in the art to utilize

the process of the combination of Kim et al. and Eichman et al. to deposit the tantalum oxide film of Kukli et al. with the reasonable expectation of (1) success, as the process / apparatus of Kim et al. is not limited to any specific ALE process but is open to an ALE process in general, and (2) obtaining the benefits of using the process of the combination of Kim et al. and Eichman et al., such as preventing unwanted contamination and deposition on the reactor walls and quickly forming uniform thin films.

Conclusion

31. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Gadgil et al. (USPN 5,879,459) teach an ALD reactor which can be heated and/or cooled during substrate processing (Col.10, lines 10 – 25).

32. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

33. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

34. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Wesley D Markham
Examiner
Art Unit 1762

WDM
November 11, 2002

MICHAEL BARR
PRIMARY EXAMINER